Committee Workshop
California's Petroleum Infrastructure Needs

2005 Integrated Energy Policy Report

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Presentation Topics

- Petroleum infrastructure – key elements
- Crude oil – overview and production
- Imports & exports – historical perspective
- Forecasts of California transportation energy demand
- Projected imports – clean fuels & crude oil
- New petroleum infrastructure projects
- Potential constraints & staff recommendations

Petroleum Infrastructure

Petroleum Infrastructure – Key Elements

- The petroleum "infrastructure" consists of several interconnected assets operated by a combination of private and common carrier companies
  - Refineries
  - Pipelines
  - Marine terminals
  - Storage tanks
- Crude oil and petroleum product infrastructure assets are separate and distinct from one another – not interchangeable
- Unlike with the electricity distribution system, Northern California is not directly connected to Southern California

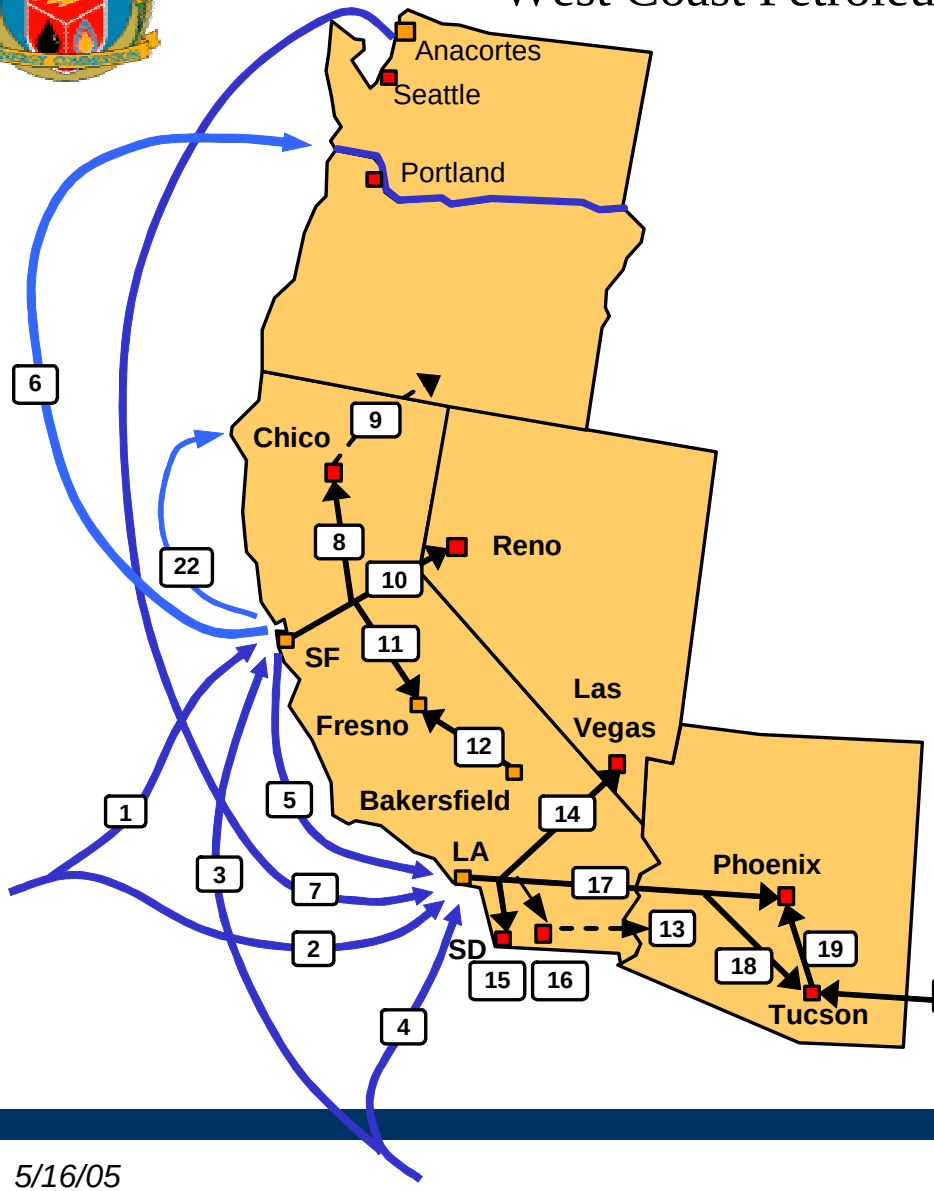
Key Elements - Refineries

- Refineries are a primary hub of logistical activity
  - Raw materials imported & finished products shipped
- Crude oil is received by pipelines and marine vessels
- Process units operate continuously at or near maximum capacity, except during periods of planned maintenance or unplanned outages

Key Elements – Refineries (cont)

- Output from the refineries is usually placed in intermediate tanks prior to blending the finished products
- The majority of gasoline, diesel and jet fuel is shipped from the refinery by pipeline to over 70 distribution terminals
- Most of the refineries dispense a smaller portion of their output into tanker trucks that are loaded at the refinery

West Coast Petroleum Flows



1 Foreign Imports into Northern California
2 Foreign Imports into Southern California
3 US Gulf Coast Imports into Northern California
4 US Gulf Coast Imports into Southern California
5 Ship/Barge - San Francisco to Los Angeles
6 Ship/Barge - San Francisco to Portland
7 Ship/Barge - Washington to Los Angeles
8 Kinder Morgan - San Francisco to Chico
9 Truck - Chico into Southern Oregon
10 Kinder Morgan - San Francisco to Reno
11 Kinder Morgan - San Francisco to Fresno
12 Kinder Morgan - Bakersfield to Fresno
13 Truck - Imperial into Western Arizona
14 Kinder Morgan - Los Angeles to Las Vegas
15 Kinder Morgan - Los Angeles to San Diego
16 Kinder Morgan - Los Angeles to Imperial
17 Kinder Morgan - Los Angeles to Phoenix
18 Kinder Morgan - Los Angeles to Tucson
19 Kinder Morgan - Tucson to Phoenix
20 Kinder Morgan - El Paso to Tucson
21 Longhorn Pipeline - Houston to El Paso
22 Ship/Barge - San Francisco to Eureka

Key Elements – Pipelines

- Pipelines are used throughout the distribution infrastructure to interconnect key elements
- Intra-state pipelines are used to convey petroleum products within California's borders
- Interstate pipelines are used to export transportation fuels to Arizona and Nevada
  - NV – Nearly 100% of supply in 2004 (153 thousand barrels per day)
  - AZ – Nearly 62% of supply in 2004 (147 thousand barrels per day)
- Pipelines usually include pump stations, break-out tanks, storage tanks and distribution terminals
- Pipelines normally traverse multiple jurisdictions and require longer periods of time to acquire all of the necessary permits

Key Elements – Marine Facilities

- Marine facilities are located in sheltered harbors with adequate draught to accommodate typical sizes of petroleum product tankers and crude oil vessels
- Wharves usually have adjacent storage tanks that are used to temporarily hold petroleum products prior to transfer to a subsequent location
- Most refiners operate a proprietary dock
- Third party storage provides access to majors and independents
  - Kinder Morgan
  - Kaneb Terminals
  - Chemoil
  - Petro-Diamond

Key Elements – Storage Tanks

- Storage tanks are vital to the continuous flow of petroleum products into and through California
- Tanks are located at docks, refineries, terminals and tank farms
- Tanks serve different storage purposes:
  - Unload marine vessels
  - Receive pipeline shipments
  - Feed truck loading facilities
  - Hold inventories in advance of planned maintenance
  - Strategic storage that can be used for emergencies or periods of rapid price increases

Key Elements – Storage Tanks (cont)

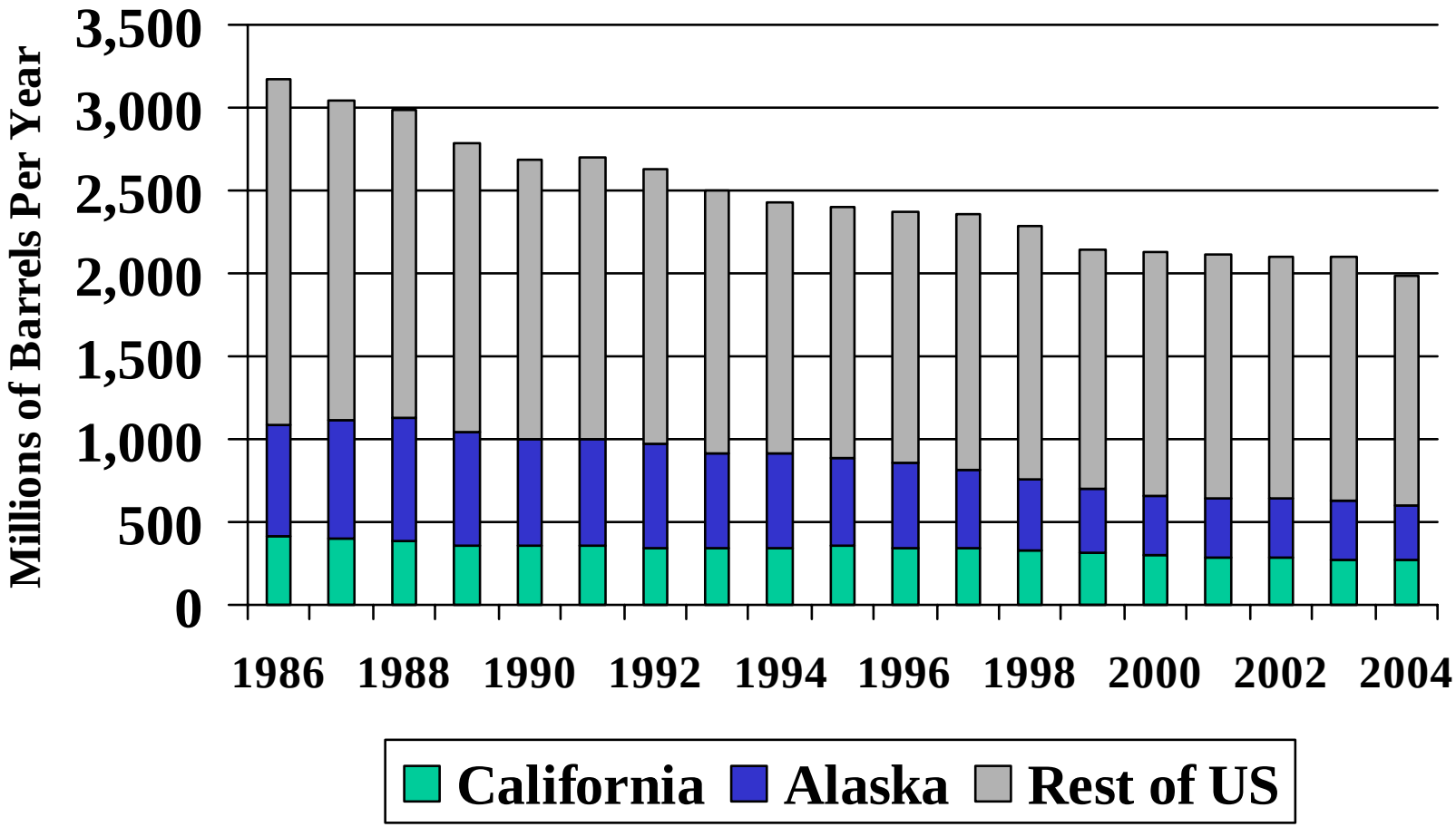
- "Dedicated" tanks are normally used for only one type of petroleum product
- "Drain dry" tanks can be used to store different types of petroleum products throughout the year, increasing versatility and flexibility for the distribution infrastructure
- Renovation of existing or construction of new storage tanks will be necessary to adequately handle the additional influx of imports foreseen over the next 10 years and beyond
- Most, if not all, of these projects will occur in locations with existing tanks

Crude Oil

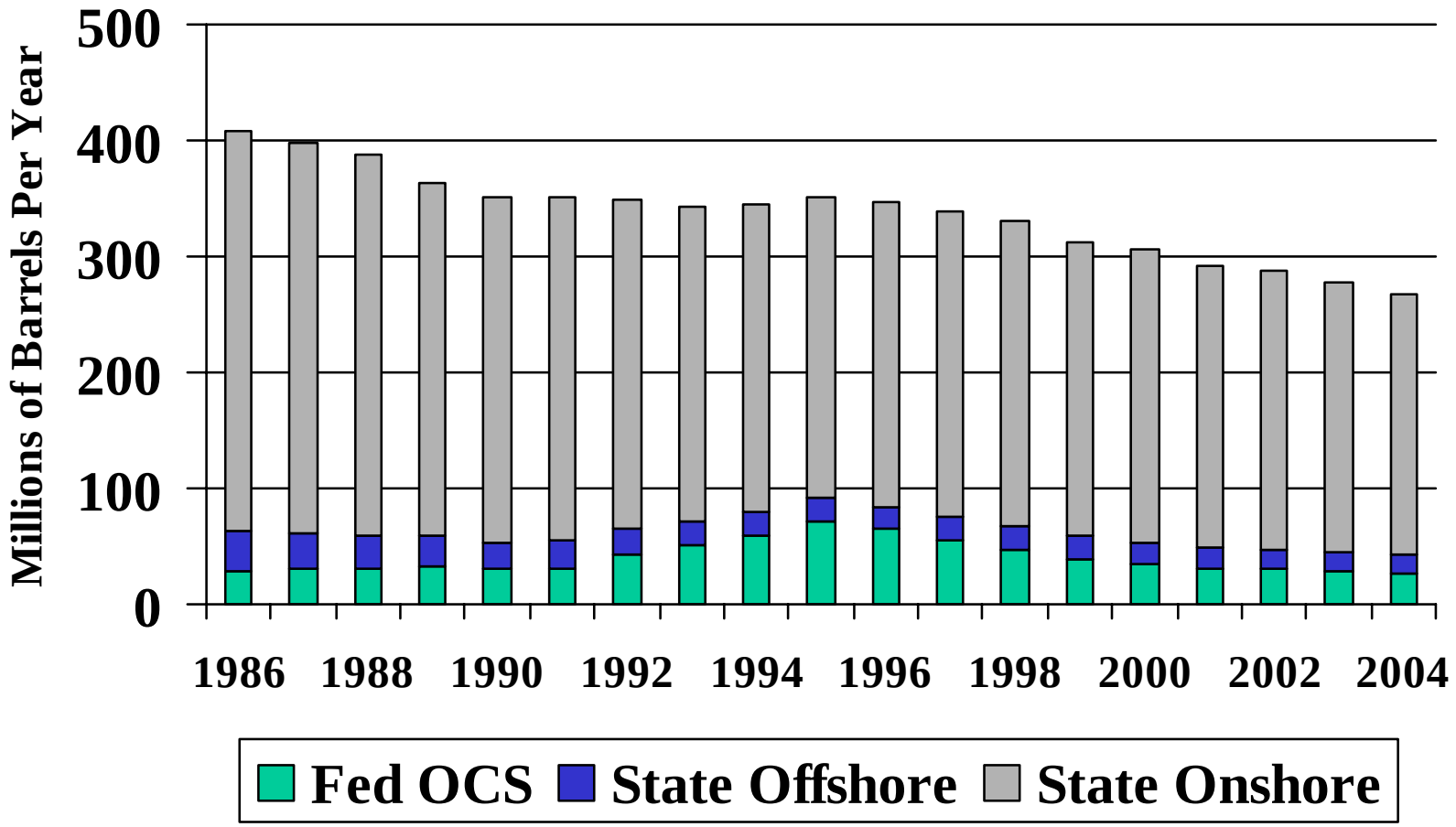
Crude Oil - Overview

- Global demand for crude oil estimated to top 84 million barrels per day for 2005
- U.S. refiners processed over 15.5 million barrels per day during 2004
  - Crude oil imports 10 million barrels per day, 65 % of supply
- California refiners processed 1.8 million barrels per day during 2004
  - California 42% (750 TBD)
  - Foreign 36% (652 TBD)
  - Alaska 22% (388 TBD)
- Declining California production will be replaced with crude oil delivered by marine vessel
- Crude oil processing by California refineries expected to gradually increase, referred to as “refinery creep”

United States Oil Production
1986 to 2004



California Oil Production
1986 to 2004

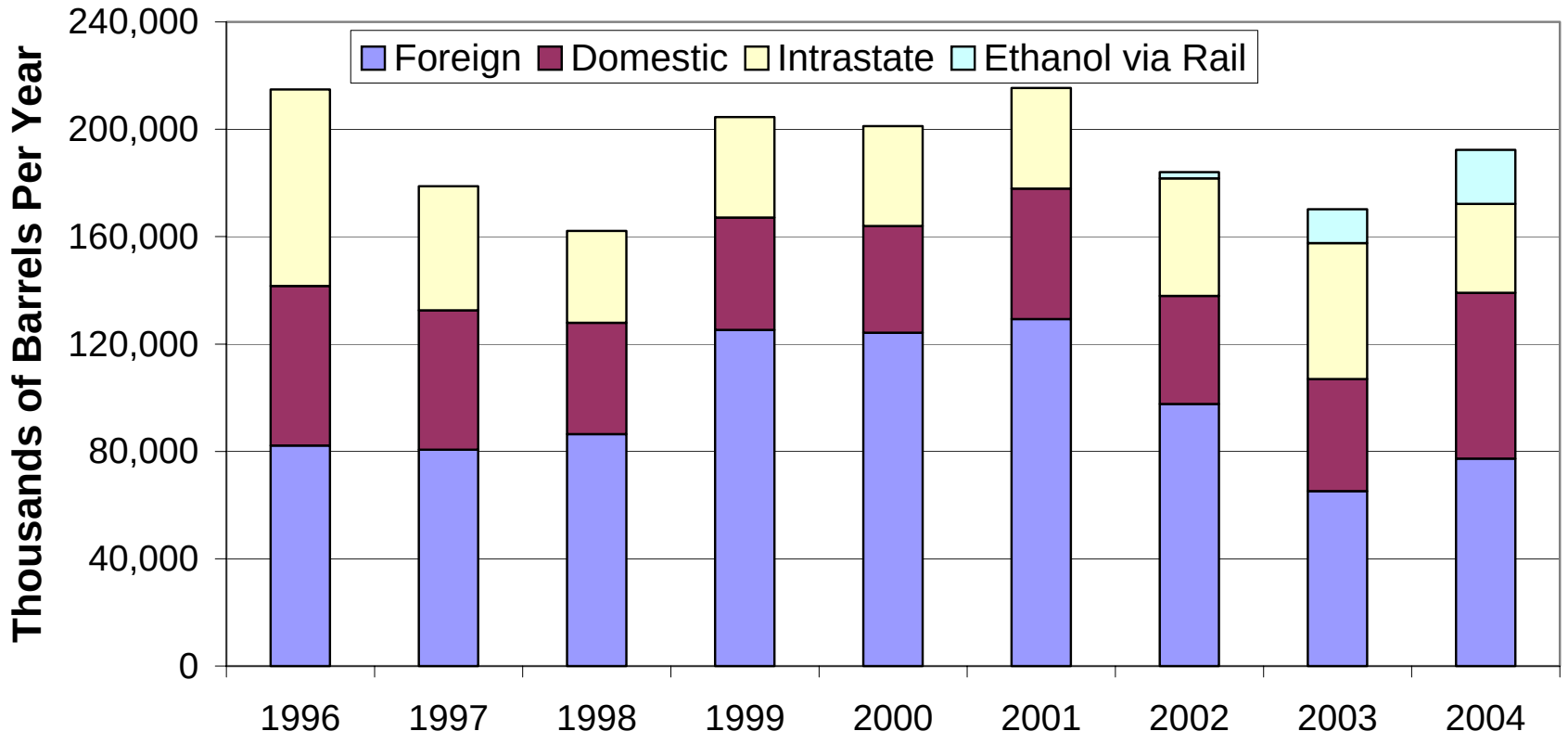


Crude Oil Production

- 2004 U.S. crude oil production 1.98 billion barrels or 5.4 million barrels per day
- 2004 California crude oil production 268 million barrels or 732 thousand barrels per day (TBD)
  - 4th largest U.S. crude oil producer behind Louisiana, Texas, and Alaska
  - 43 % enhanced recovery, mostly steam injection
- California crude oil production has declined 34 % since 1986, Alaska 51 % and the rest of U.S. by 34 %
  - Alaska output remained steady between 2000 and 2003, reversing a declining trend that had continued for a decade
  - Although Alaska output declined by nearly 7 % last year
- California crude oil production declined 19 % between 1998 and 2004, despite the fact that the value of oil increased by 210 %

Imports & Exports

California Petroleum Combined Movements Refinery Feedstocks, Blending Components and Finished Products (Excludes Crude Oil) 1996 through 2004



Imports & Exports - Historical

- California shifted from a net exporter of finished petroleum products (transportation fuels) by marine vessel to a net importer in 1997
- Imports of petroleum products are generally increasing while exports are continuing to decline
  - Combined marine imports increased by 61% between 1996 and 2001 before declining 25% between 2001 and 2004
    - 103 million barrels in 2004 or 281 thousand barrels per day (TBD)
  - Combined marine exports declined by 36% between 1996 and 2004
    - 36 million barrels in 2004 (98 TBD)

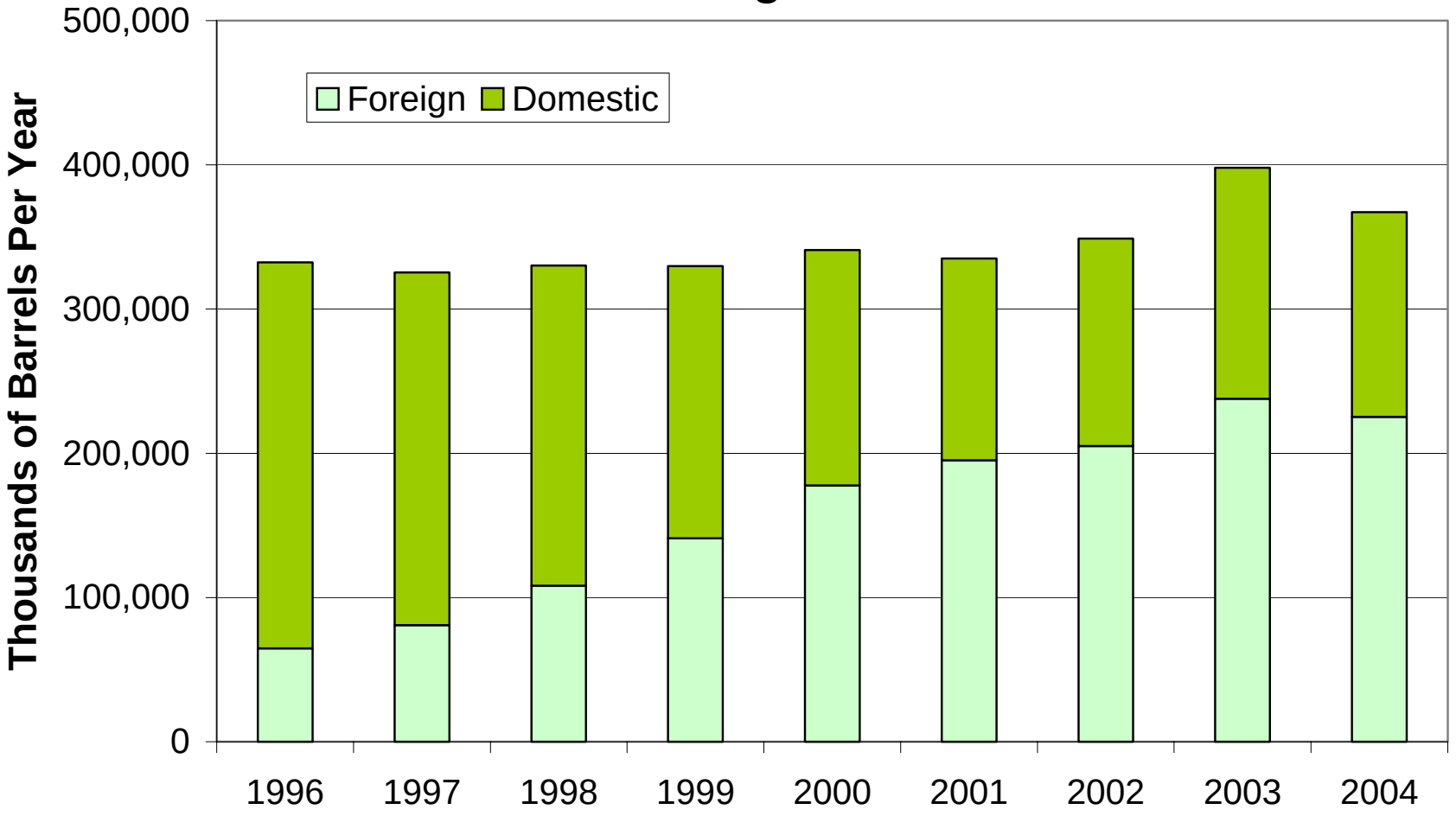
Imports & Exports – Historical (cont)

- Exports and imports of like petroleum products use similar facilities
  - Ships loading products occupy dock space and can prevent another vessel from unloading a cargo of fuel
  - Domestic movements – 62 million barrels in 2004 or 169 TBD
  - Foreign movements – 77 million barrels in 2004 or 210 TBD
- Intrastate movements also contribute to congestion at docks
  - Barges are a primary means of transport
  - Intrastate movements – 33 million barrels in 2004 or 90 TBD

Imports & Exports – Historical (cont)

- Various factors impact these petroleum product totals
  - Refinery reliability
    - Greater number of outages/planned maintenance can increase need for imports & intrastate movements
  - Health of the economy
    - Jet fuel imports declined 12 million barrels between 2000 and 2002
  - Improved efficiency through exchange agreements can help
  - Modest refinery projects also contribute incremental supply

California Crude Oil Imports
1996 through 2004



Imports & Exports – Historical (cont)

- Imports of crude oil have increased as California crude production fell and refineries processed additional oil
- Total imports of crude oil have only increased 10.5 % between 1996 and 2004
- Imports of Alaska crude oil declined a total of 47 % between 1996 and 2004
- The largest increase has been for foreign crude oil imports
  - 16.8 % per year increase
- Total imports of crude oil in 2004 declined 7.8 % compared to 2003
  - Refinery maintenance work greater than normal resulted in a decline of crude oil processing for the year

Forecasts of California Transportation Energy Demand 2005-2025

Fuel Types and Sectors

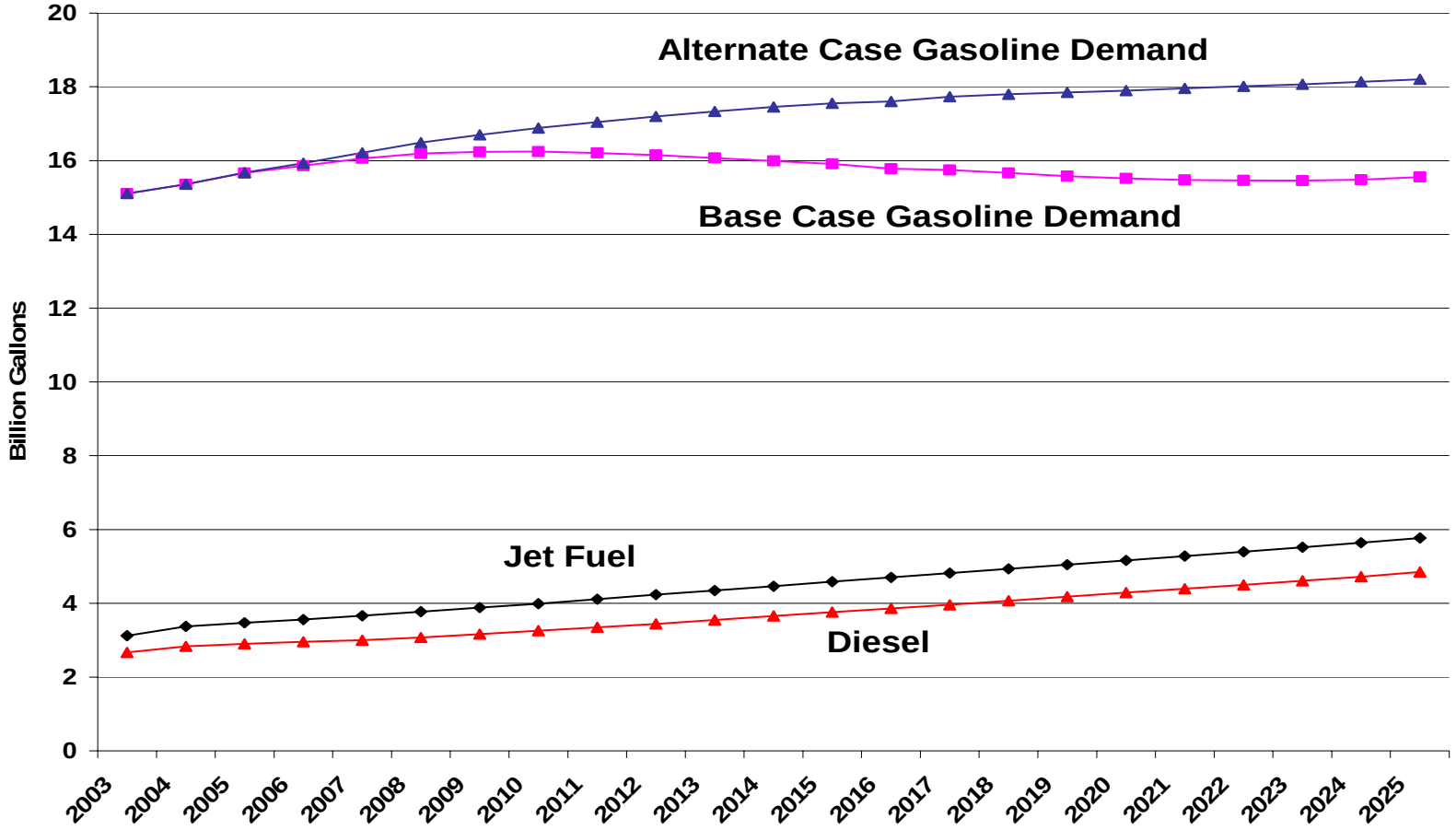
- Gasoline
- Diesel
- Electricity
- Natural Gas
- Commercial Jet Fuel

- Freight
- Transit
- Commercial Aviation
- Private light-duty vehicles
- Commercial light-duty vehicles

Key Assumptions

- Gasoline and diesel fuel prices based on 2005 EIA Crude Oil Price Forecast from *Annual Energy Outlook*. Gasoline price: $2.16 in 2004, $2.26 in 2025. Diesel price: $2.13 in 2004, $2.20 in 2025.
- Jet fuel prices based on FAA forecast
- Population grows by an average of 1.15 % per year, employment by 1.5 % per year, personal income by 2.3 % per year
- Forecast for electric hybrid light-duty vehicles consistent with CARB ZEV requirements
- Diesel light-duty vehicles available starting in 2008
- Base case forecast assumes greenhouse gas regulations; alternative forecast does not

Demand Forecast Results



Demand Forecast Results

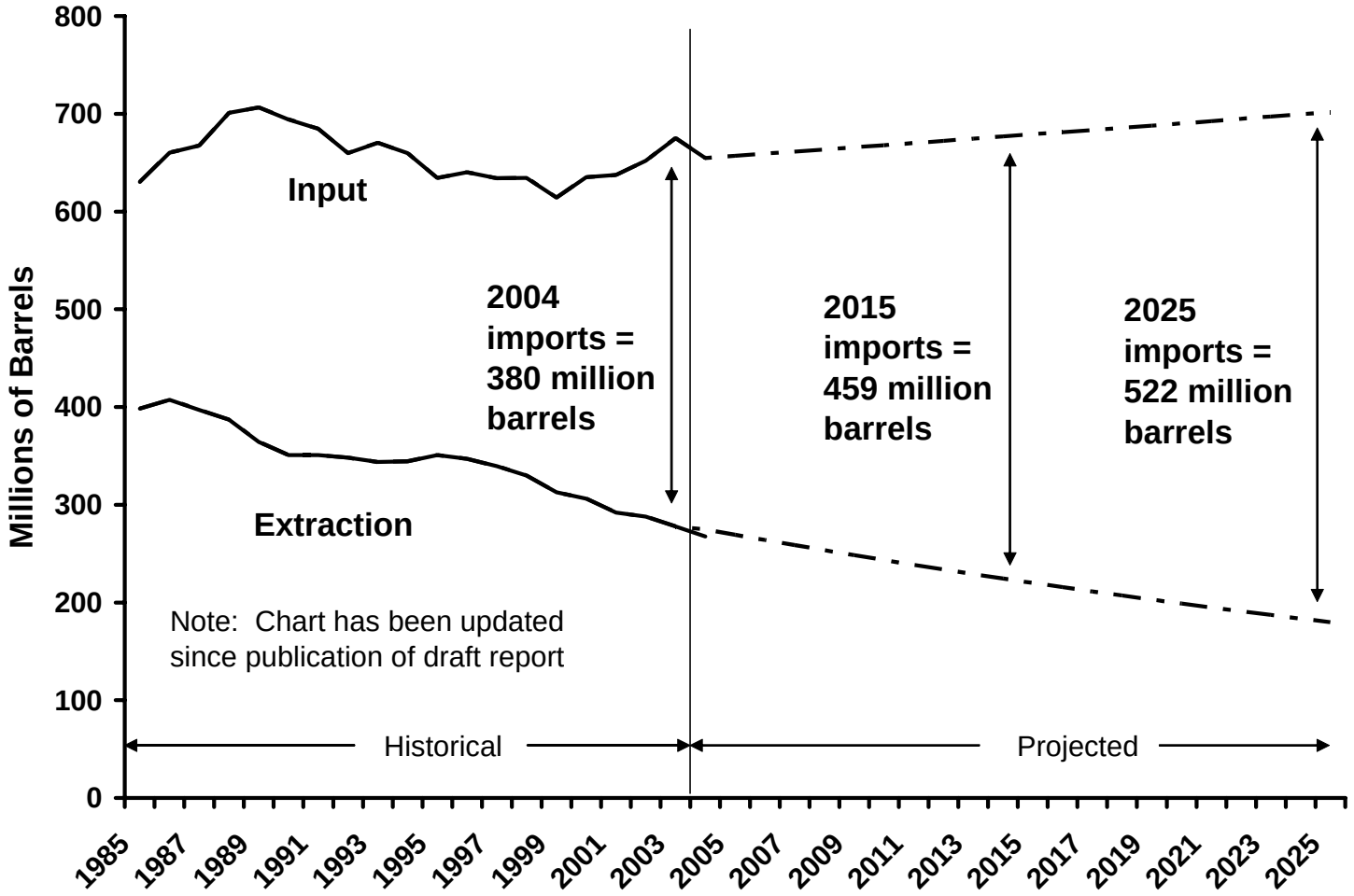
- Base case and alternative case demand forecasts for gasoline, diesel and jet fuel
- **Gasoline demand** in California grows by an average of 0.1% per year in the base case forecast and by 0.9% in the alternative forecast from 2005-2025
- **Diesel demand** grows by an average of 2.7% per year in the base case forecast and by 2.9% in the alternative forecast
- **Jet fuel** demand grows by an average of 2.9 % per year
- Average **fuel efficiency** rises by 33% over the forecast period in the base case and by 10% in the alternative case

Comparison with 2003 IEPR Forecast

Lower average annual rate of growth in gasoline demand in 2005 forecast versus 2003 forecast, even with no implementation of greenhouse gas regulations: 1.35% in 2003 forecast, 0.9% in 2005 alternative forecast. Reasons:

- Lower projected population growth
- More light-duty diesel vehicle sales
- Increase in fuel efficiency for conventional gasoline vehicles in 2005 forecast, no increase in 2003 forecast

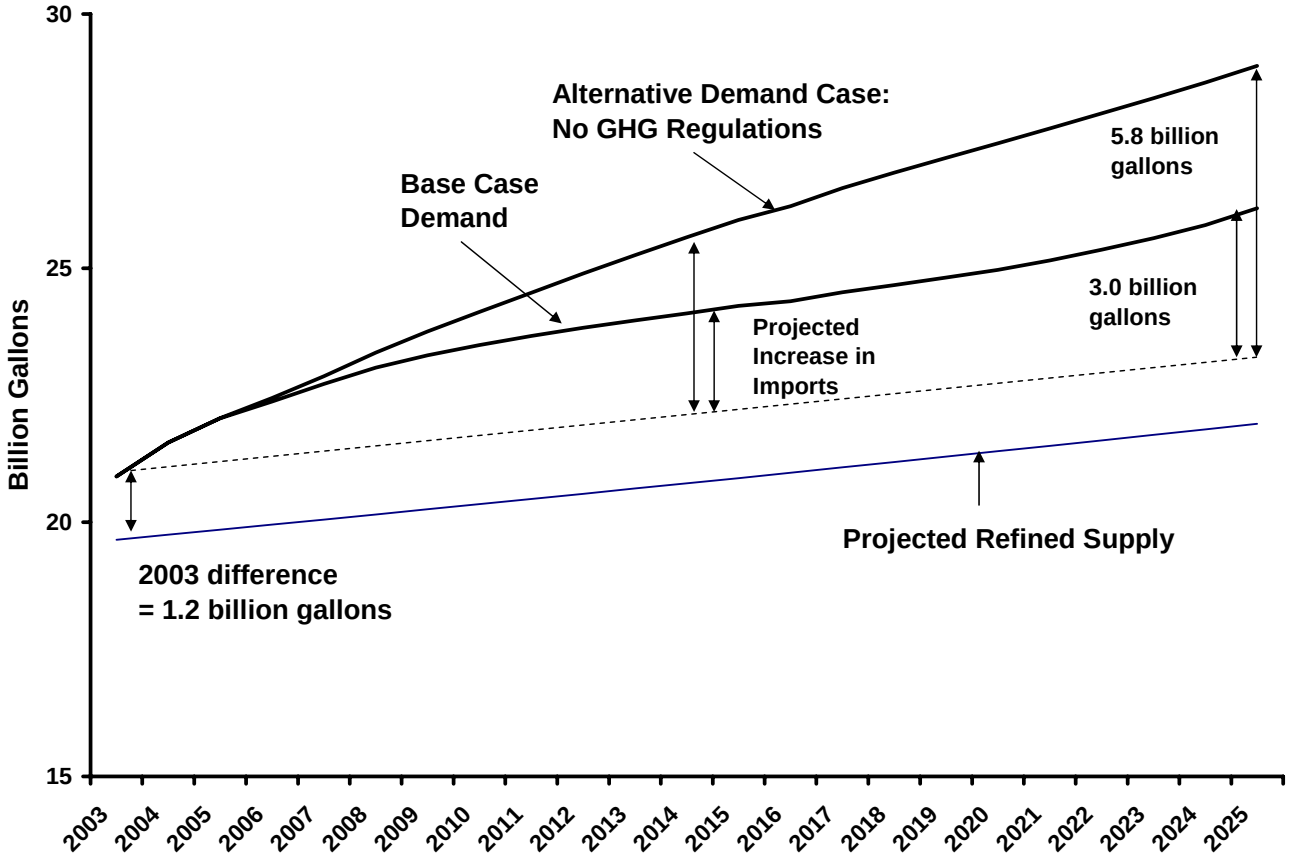
Crude Oil Import Projection



Crude Oil Import Projection (cont)

- Compared projections of crude oil extraction in California and required refinery crude oil input
- Crude oil extraction projected to decline at average rate over the last 20 years: 2% per year
- Refinery input projected to increase at the average rate of growth in the capacity to process crude oil for all California refiners from 1996 to 2004, around 0.3% per year
- Crude oil imports are projected to increase from 380 million barrels per year in 2004 to 459 million barrels in 2015 and to 522 million barrels by 2025
- If the crude oil extraction rate is greater (3.5%) and the capacity to process crude oil increases at a higher rate (0.6%) then crude oil imports will increase to 514 million barrels in 2015 and 612 million barrels by 2025

Clean Fuels Import Projection



Clean Fuels Import Projection (cont)

- Annual production increase by California refiners, or "refinery creep," projected to be 0.5%
- Base case demand forecast -- clean fuels imports increase over the 2003 level by
  - 3.0 billion gallons in 2025
  - 2.1 billion gallons in 2015
- Alternative forecast – clean fuels imports increase by
  - 3.8 billion gallons in 2015
  - 5.8 billion gallons in 2025

Projected Imports - Sensitivity

- Tradeoff between crude oil and clean fuels imports: **higher "refinery creep"** means less imports of clean fuels and **more crude oil imports**
  - Example: 1% annual increase in crude oil distillation capacity along with 3.5% annual decline in extraction increases crude oil imports 30% by 2025
  - Example: If greenhouse gas regulations are not implemented and clean fuels demand grows2 % (average over the last 20 years), imports of clean fuels rise by more than 100% over the base case and 50% over the alternative case by 2025

Projected Increases in Imports

Table 3
Projected Increases in Imports for 2015 and 2025, by Region

	2015		2025	
	Bay Area	L.A. Basin	Bay Area	L.A. Basin
Crude Oil	30 million barrels	45 million barrels	56 million barrels	84 million barrels
Clean Fuels: Base Case Demand	0.4 billion gallons	1.7 billion gallons	0.6 billion gallons	2.4 billion gallons
Clean Fuels: Alternative Demand Case	0.8 billion gallons	3.1 billion gallons	1.2 billion gallons	4.6 billion gallons

Note: the sum of Bay Area and L.A. Basin projections may not match the totals in Table 2 due to rounding error.

- Projected volumetric increases greatest in Los Angeles Basin for both crude oil and clean fuels
- Good news - work has either been recently completed or is underway that will address a portion of these anticipated needs

New Petroleum Infrastructure Projects

New Projects – Refineries

- Paramount Petroleum project to produce California gasoline and diesel fuel
- Permit approved June 18, 2004
- New production of gasoline and diesel fuel could begin by end of 3rd quarter 2005
- 7.5 TBD of gasoline and 8.7 TBD of diesel fuel important supply additions
- Big West – project to expand gasoline and diesel production under consideration for Bakersfield facility

New Projects – Pipelines

- Kinder Morgan North Line expansion project initiated July of 2001
- Pipeline transports petroleum products from Concord to West Sacramento
- Main line construction began first week of June 2004
- New pipeline became operational December 2004
- Project will increase capacity by over 30% and will satisfy growth for the next 10 to 20 years, but took 35 months to receive approval

New Projects – Marine Facilities

- Crude oil import infrastructure projects being discussed for the Ports of Los Angeles and Long Beach
- Pacific Energy Partners looking to develop Pier 400 in the Port of Los Angeles
- Oiltanking looking to develop deep water crude import facility in Long Beach
- Either development would require additional tankage and pipeline infrastructure
- Pressure to delay or block such projects could impact crude oil availability

New Projects – Storage Tanks

- Kaneb recently completed construction of new storage tanks for clean products in 2004
- Expansion continues
- Adequate land space and pipeline access are key attributes
- Facility has approved EIR
- Most other storage expansion projects will require the development and approval of an EIR prior to commencement of new construction
- Recent storage projects have experienced significant delays

New Projects – Storage Tanks (cont)

- Kinder Morgan project to expand their existing Carson storage facility in Southern California
- Could eventually add 19 new storage tanks over a 15 year period
- 1.5 million barrels of additional storage capacity
- Approval of conditional use permit was appealed last year
- Permit to construct approved 2-23-05
- Project delayed at least 9 – 12 months
- Construction underway for the initial 4 tanks

New Projects - Projected Needs

Table 5
Estimates of Additional Required Storage (in Barrels) for Imports of Clean Fuels

Year	Scenario	Total Projected Additional Storage Required	Projected Additional Storage Required for Bay Area	Projected Additional Storage Required for L.A. Basin
2015	Base Case Forecast	4.2 million	0.8 million	3.4 million
	Alternative Forecast	7.6 million	1.6 million	6.0 million
2025	Base Case Forecast	6.0 million	1.2 million	4.8 million
	Alternative Forecast	11.6 million	2.4 million	9.3 million

- Projected storage tank capacity need greatest in Los Angeles Basin for clean fuels

New Projects - Summary

- Assuming existing petroleum infrastructure capacity is retained, an additional 2.8 to 7.3 million barrels of new storage capacity will be needed to the Los Angeles Basin to handle to projected clean fuels imports
- The Bay Area requirements for additional clean fuels storage capacity is far less, 700 thousand barrels in the alternative demand case, assuming permitted capacity expansions are completed
- If one of the proposed crude oil import terminals is constructed in the Los Angeles Basin, crude oil import capacity should be sufficient to handle the projected imports
- But Bay Area will likely need additional crude oil terminal capacity over the forecast period

New Projects – Summary (cont)

- These additional projects will be necessary to ensure an adequate supply of crude oil can reach the refineries and an adequate supply of transportation fuels can be dispensed to California's consumers

- But there remain potential problems retaining existing petroleum infrastructure, as well as potential constraints to accommodating these future increased imports of crude oil and clean fuels

Potential Constraints – Storage Capacity

- Storage tanks in the Los Angeles Basin have been decommissioned over the last several years, reducing capacity
- Further loss of petroleum infrastructure assets could place additional pressure on this intermittently constrained system
- Recent applications for new petroleum infrastructure projects have been rejected and renewal of leased property in the Port of Los Angeles has been denied – no recourse available

- Staff recommendation:
  - "Lease renewal appeals process"

Potential Constraints – Project Delays & Local Opposition

- Recent petroleum infrastructure projects have experienced significant delays
- New projects or expansions have been met with opposition from various stakeholders
- Staff recommendations:
  - "Energy Commission acts as permit facilitator"
  - "One-stop permitting process for projects crossing jurisdictional boundaries"
  - "Greater participation by Energy Commission to provide factual information"
  - "Involve local/state agencies to a greater degree in petroleum infrastructure planning"

Potential Constraints – Marine Access

- Marine Oil Terminal Engineering and Maintenance Standards could result in the closure of a portion of the marine petroleum infrastructure, especially clean fuels
- Staff recommendation:
  - "Monitor impact of MOTEMS"

- Access to third party storage can be limited
- Increased imports of petroleum products by new suppliers could be constrained
- Staff recommendation:
  - "Arbitration mechanism to resolve access issues"

Potential Constraints – Dredging

- **Adequate dredging** is a **vital** component to ensuring efficient use of marine facilities
- Inadequate draft has resulted in additional ship movements and additional costs
- Northern California requires more frequent dredging due to active river system
- Timely dredging of key Bay Area bottlenecks, such as Pinole Shoal, has **not been consistent**
- **Lack of adequate federal funds** to complete all necessary work primary cause
- Staff recommendation:
  - Firm federal funding mechanism